DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Draft: September 29,2000

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: NRG Fossil Fuel Plant – Norwalk Harbor
Facility Address: Manresa Island Ave, South Norwalk, CT
Facility EPA ID #: CTD 000845214

1. Has all available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been considered in this EI determination?

   _X_ If yes - check here and continue with #2 below.

   ____ If no - re-evaluate existing data, or

   ____ if data are not available, skip to #8 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives, which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations

associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Is groundwater known or reasonably suspected to be "contaminated"[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

   __X__ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

   _____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

   _____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s): See notes under Section 750-2 in attached text

3. Has the migration of contaminated groundwater stabilized (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

   __X__ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

   _____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

   _____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s): See notes under Section 750-3 in attached text

Footnotes:

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does "contaminated" groundwater discharge into surface water bodies?

__X__ If yes - continue after identifying potentially affected surface water bodies.

____ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s): See notes under Section 750-4 in attached text

5. Is the discharge of "contaminated" groundwater into surface water likely to be "insignificant" (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

__X__ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):): See notes under Section 750-5 in attached text

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. **Can the discharge of "contaminated" groundwater into surface water be shown to be "currently acceptable" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?**

____ If yes - continue after either:
1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR
2) providing or referencing an interim-assessment,[5] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

____ If no - (the discharge of "contaminated" groundwater can not be shown to be "currently acceptable") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s): In accordance with the instructions for Section 5, this section is not applicable for "insignificant" discharges.

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater monitoring / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

__X__ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no - enter "NO" status code in #8.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s): See notes under Section 750-7 in attached text.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

__X__ Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the NRG Fossil Fuel – Norwalk Harbor facility, EPA ID # CTD000845214, located at South Norwalk Connecticut. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

_____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

_____ IN - More information is needed to make a determination.

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Completed by (signature) _____ Date 9/29/00
(print) JUAN A PEREZ
(title) Environmental Scientist

Supervisor (signature) _____ Date 9/29/00
(print)
(title) Matthew R. Haagland – Section Chief, RCRA Corrective Action Section
EPA Region or State) Reg. I.

Locations where References may be found:

Report on Phase I of Groundwater Quality Assessment Monitoring Program (March 15, 1988
RCRA Groundwater Monitoring Program 1997 Annual Report (CL&P)
March, 1999 Phase I Environmental Site Assessment (Metcalf & Eddy, Inc.)
April, 1999 Phase II Environmental Field Investigation Report (Metcalf & Eddy, Inc.)
November, 1999 Supplemental Site Investigation Report (Metcalf & Eddy, Inc.)

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Rationale and References
For
Documentation of Environmental Indicator Determination
RCRA Corrective Action Environmental Indicator Code CA 750

Groundwater monitoring was initiated at Norwalk Harbor ("the Site") pursuant to a May 17, 1985 Memorandum of Understanding with the USEPA, in order to determine the impact of a single-membrane-lined surface impoundment (EB-2) on groundwater quality in the facility's uppermost aquifer. That unit, operated as part of its NPDES-permitted wastewater treatment system, was constructed by excavating into compacted coal fly ash deposits which cover a large area of the site in the vicinity of the impoundment. It was designed to receive maintenance washwaters prior to their eventual discharge to the Norwalk Harbor. Because some of these washwaters were determined to be RCRA hazardous, due to corrosivity or EP Toxicity, the unit operated under RCRA interim status until its closure.

The quarterly groundwater monitoring program first reported statistical "trips" for pH in December, 1986. A report entitled "Assessment Monitoring Phase I" was issued on March 15, 1988. This report, which detailed groundwater monitoring results to that date, indicated that the surface impoundment was the source of a significant portion of (pH) groundwater contamination in downgradient monitoring wells, but that other indicator parameters (specific conductance, TOC and TOX) originated from former coal fly ash settling ponds and coal residue located at the site.

Based on these results, NUSCO proceeded with Phase II of the Assessment Monitoring Plan, designed to more clearly establish hydrogeologic conditions in the vicinity of the impoundment and define the nature and extent of any contaminant plume which may have emanated from it. Constituent isoconcentration contour mapping conducted as part of that Assessment, indicated that the former surface impoundment could not be shown to have had a quantifiable impact on site groundwater.

EB2 was closed as a RCRA landfill in 1990, under the oversight of USEPA Region I. Sludge and liner material was removed and disposed, and a total of 28 sub-liner soil samples were collected from the upper 18-inch soil layer below the liner. The analytical data indicated that the oil-fired byproducts (vanadium and nickel) from EB2 are readily attenuated by the subsoils, and that exceedances of other inorganics constituents may be more indicative of historic coal fly-ash deposits prior to construction of EB2.

A groundwater assessment monitoring program was initiated during 1989, in conjunction with RCRA closure. This included installation of 22 additional shallow and deep monitoring wells, resulting in a total of 30 wells in the vicinity of the closed EB2 unit. Quarterly groundwater samples were initiated, in accordance with RCRA post-closure monitoring requirements, in June of 1989. In September of 1994, the EPA approved a reduction in the number of monitoring wells required to be sampled, as well as a reduction in sampling frequency from quarterly to semi-annually, and elimination of analysis for VOCs in samples from the monitoring wells.

750-2 Groundwater Contamination Determination

The CTDEP classification of groundwater at the site is "GB", not suitable for drinking. The site is bordered to the south by the Long Island Sound, to the south by Sheffield Island Harbor, and to the east by Norwalk Harbor, which serves as the discharge point for the Norwalk Harbor. In addition, historical documents indicate that the eastern portion of the property, on which the EB-2 unit was constructed, was formerly a tidal marsh, which was filled, in order to accommodate facility construction. Consequently, the CTDEP's Surface Water Protection Criteria ("SWPC") is of primary importance when evaluating groundwater contamination at the site. Groundwater quality data will, therefore, be compared to the SWPC.

As stated, the 1997 Groundwater Monitoring Annual Report indicated that several compounds exceeded Federal and Connecticut Department of Health Services Maximum Containment Levels. Analytical results from the 11/12/97 groundwater sampling round were compared to the CTDEP's current SWPC. Contaminant levels in the following groundwater samples met or exceeded those criteria.

Monitoring Well Number	Contaminant Name	Contaminant Conc. (mg/l)	SWPC (mg/l)
NH-2S	Beryllium	0.004	0.004
	Cadmium	0.060	0.006
	Nickel	1.080	0.88
NH-5S	Arsenic	0.302	0.004
NH-8S	Beryllium	0.032	0.004
	Cadmium	0.031	0.004 0.006
	Nickel	1.03	0.88
NH-10S	Lead	0.032	0.013
NH-13S	Arsenic	0.123	0.004
	Cadmium	0.026	0.006

In March of 1999, a Phase I Environmental Site Assessment ("ESA"), was prepared to identify potential areas of environmental concern ("AOCs") at the Norwalk facility, and to review prior environmental investigations. Subsequently, a limited Phase II ESA was prepared in April, 1999, in order to investigate potential contamination at the AOCs identified during the Phase I ESA. A direct push Geoprobe® unit was used to collect soil and groundwater samples from various locations throughout the facility. A total of 13 groundwater samples were collected from the Geoprobe® borings.

Groundwater results in excess of the SWPC were encountered in four (4) groundwater samples collected from three (3) of the AOCs. They are listed in the following table.

Monitoring Well Number	Contaminant Name	Contaminant Conc. (mg/l)	SWPC (mg/l)
ME-NRK-2	Arsenic (dissolved)	0.29	0.004
	Cadmium (dissolved)	0.0066	0.006
	Zinc (dissolved)	0.37	0.123
ME-NRK-4	Cadmium (dissolved)	0.032	0.004 0.006
	Lead (dissolved)	0.031	0.004 0.013
	Nickel (dissolved)	1.03	0.88
	Zinc (dissolved)	1.6	0.123
ME-NRK-21	Phenanthrene	33	0.3 0.000077
ME-NRK-25	Zinc (dissolved)	0.14	0.123

As part of the supplemental investigations conducted in September, 1999, groundwater samples were collected from three (3) of the existing on-site RCRA monitoring wells, and analyzed for priority pollutant metals. Two (2) of the samples exhibited the following contaminants above the SWPC.

Monitoring Well Number	Contaminant Name	Contaminant Conc. (mg/l)	SWPC (mg/l)
NH-2S	Arsenic	0.038	0.004
	Beryllium	0.011	0.004
	Zinc	2.7	0.123
NH-3S	Zinc	0.38	0.123

750-3 Migration Stabilization Evaluation

As stated, the initial monitoring well network was installed in 1985, in order to evaluate groundwater quality in the vicinity of the EB2 surface impoundment. CL&P removed known and potential groundwater contamination sources from this AOC in 1991, when EB2 was closed in accordance with RCRA standards.

While incinerator ash remains in the northeastern portion of the site, this material is not subject to RCRA, and consequently is not "contaminated" according to the definition provided.

750 – 4 Contaminated Groundwater Discharge to Surface Water Evaluation

The facility is located on a peninsula which is bordered to the south and west by the Long Island Sound, and to north by Norwalk Harbor. The RCRA groundwater assessment monitoring program established that the site is ~~underlain by a~~ two aquifer system separated by a somewhat leaky semi-confining layer. The upper aquifer is composed predominately of fine grained sediments indicative of a tidal marsh, while the lower aquifer consists mostly of clean sands and gravel, suggestive of a near shore/beach depositional

environment. The semi-confining layer is composed of organic silts and clays, and appears to be contiguous across the majority of the study area.

As part of the Assessment of Phase I of the Groundwater Quality Monitoring Program, groundwater table elevations were measured from August 1985 to December 1987. It was determined that the groundwater table elevations varied monthly, ranging from about two (2) feet in most wells to almost four (4) feet in NH-1 (to the south of the former EB2 unit). Flow was determined to be radially outward from an apparent groundwater mound from the well to the north of EB2 toward a tidal marsh to the west-northwest and Long Island Sound or Norwalk Harbor in all other directions. The tidal marsh was identified as a sink for groundwater flowing from the impoundment area and for background water flowing towards it.

The 1997 RCRA Groundwater Monitoring Annual Report shows continued variability in groundwater elevation. Groundwater elevation changes in shallow wells were positively correlated over time, with seasonal rise and falls in the water table reflected in the upper aquifer monitoring network. Water level changes in the lower aquifer were somewhat less positively correlated, although they demonstrated similar general trends. It was determined that shallow groundwater flow is directed generally to the south or east (towards the Long Island Sound). Groundwater flow rates were calculated to range from 1 to 23 meters/year in the upper aquifer, and between 0.45 and 36 meters/year in the deeper aquifer.

The data table at 750-2 shows a limited number of contaminants above SWPC, raising the possibility that contaminants may be discharging to the Long Island Sound in excess of SWPC levels. It is important to note, however, that the Long Island Sound is saline, and is classified by the CTDEP as SB/SA. This classification indicates that the water does not presently meet Water Quality Criteria or one or more designated uses. The water quality goal is achievement of Class SA Criteria and attainment of Class SA designated uses.

750 – 5 Evaluation of Significance of Contaminated Groundwater Discharge to Surface Water

While contaminants have been detected in groundwater in excess of SWPC, it is not known whether contaminants have actually discharged to the Connecticut River at or above those concentrations. Based upon RCRA groundwater monitoring results, it appears that contaminant concentrations have decreased during the course of that monitoring, and will continue to decrease with further monitoring. In addition, flow calculations indicate that, due to the high base flow in Long Island Sound, it is highly unlikely that groundwater contaminated in excess of SWPC would adversely impact that water body.

Based upon the location of the previous goundwater samples collected at the site, Two (2) existing monitoring wells and three (3) temporary wells installed in Geoprobe ® borings, located closest to Norwalk Harbor, and the Long Island Sound were chosen to evaluate the potential impact of contaminated groundwater on surface water.

As can be seen from the tables at 750-2, arsenic, beryllium, cadmium, and nickel were detected in one (1) of the groundwater samples at concentrations of 0.038 mg/l, 0.011 mg/l, and 1.3 mg/l, respectively. Zinc was detected in four samples at concentrations ranging from 0.38 mg/l and 2.7 mg/l. Phenanthrene was detected in one (1) of the five (5) ground water samples at a concentration of 33 ug/l.

The estimated flow of groundwater to the river was calculated to be 0.00340 ft^3/sec based upon the site's physical settings and estimated hydrogeological values. Based upon a dilution multiplier developed for the compounds detected and the estimated groundwater flow rate, the minimum flow of the Norwalk River required for arsenic, cadmium, lead, nickel, zinc, and phenanthrene are 0.032 ft^3/sec, 0.011 ft^3/sec, 0.004 ft^3/sec, 0.005 ft^3/sec, 0.133 ft^3/sec, and 0.374 ft^3/sec, respectively.

Though there is no flow data available for the Norwalk River or for Norwalk Harbor near the generating station. However, data obtained from the USGS gauging station located approximately seven (7) miles north of the generating station indicates that the annual seven-day minimum flow for the river at that location is 0.91 ft^3/sec. Therefore, based upon the volume of water at that location in the Norwalk River, along with the volume of water flowing through the harbor and the sound, there would be sufficient flow to allow the detected contaminants in the groundwater to meet the SWPC.

750 – 7 Future Groundwater Monitoring

The facility is currently under the purview of the CT Property Transfer Act. It is also subject to the groundwater monitoring requirements of RCRA. These programs will provide for further , on-going groundwater monitoring, and verify that contaminated groundwater has remained within the dimensions of the "existing area of groundwater contamination."